Evolution of $Ca_{2-x}Na_xCuO_2Cl_2$ from Mott Insulator to High-T_c Superconductor :
"The Story from Einstein's Electrons"

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This year marks the centennial of Einstein's "miracle year" where, amongst other accomplishments, he published his celebrated explanation of the photoelectric effect. In the past decade, this phenomenon has emerged as an extremely powerful tool for studying electronic structure in the solid-state. In particular, high-resolution angle-resolved photoemission spectroscopy (ARPES) has played a leading role in elucidating the nature of the low-lying electronic states in the high-temperature cuprate superconductors. We report ARPES studies of $Ca_{2-x}Na_xCuO_2Cl_2$ which probe how the single-electron excitations develop throughout momentum space as the system is doped from an antiferromagnetic Mott insulator to a high-T_c superconductor. Our ARPES measurements indicate that, due to very strong correlations, the quasiparticle residue, Z, approaches zero in the parent Mott insulator. As a result, many fundamental quantities such as the chemical potential, quasiparticle excitations, and the Fermi surface evolve in manners wholly unexpected from conventional weakly-interacting theories. We have also observed highly aniostropic interactions in momentum space where quasiparticle-like excitations persist to low doping levels along the nodal direction of the *d*-wave superconducting gap, in contrast to the unusual excitations near the *d*-wave antinode. This anisotropy may reflect the propensity of the lightly doped cuprates towards forming a competing, charge-ordered state, as recently observed by scanning tunneling microscopy experiments.